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The Feelings of Goals Hypothesis: Emotional Feelings are Non-Conceptual, Non-Motoric Representations of Goals

Assaf Kron
Department of Psychology, University of Haifa, Haifa, Israel
Assaf Weksler
Department of Philosophy, University of Haifa, Haifa, Israel

Abstract

This paper proposes and develops the feelings of goals hypothesis (FGH). It has two aims: first, to describe the evolutionary function of emotional feelings (EFs), and second, to describe the content and the format of EFs. According to FGH, the evolutionary function of EFs is to enable motoric flexibility. Specifically, EFs are a component of a psychological mechanism that permits differential motoric reactions to the same stimulus. Further, according to FGH, EF is a special type of mental representation with the content of an action goal, and with a non-motoric, non-conceptual format. This paper thoroughly clarifies the assumptions underlying FGH and discusses its theoretical implications and empirical predictions.

Keywords
emotional feelings, goal, action tendency

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A fundamental question in emotion theory is: what is the content of emotional feelings (EFs) (e.g., Lambie & Marcel, 2002)? For example, what information is carried by experiences of fear, disgust, and envy? Several different answers have been given to this question throughout the history of emotion theory, including that EFs are interoceptions of bodily changes (e.g., James, 1890), feedback from facial expressions (e.g., Tomkins, 1962), representations of value (e.g., Brown, 1990), experienced arousal and cognitive evaluations thereof (e.g., Schachter & Singer, 1962), and felt action tendencies (Arnold & Gasson, 1954; Deonna & Teroni, 2017; Frijda, 2004, 2005; Mitchel, 2020; Moors, 2017), which is the focus of the current discussion. The "felt action tendencies" account suggests that EFs are feelings that are constitutively related to readiness to act. Within the "felt action tendencies" tradition, there are at least two ways to understand the relationship between the action tendency and the EF: the first is that the EF is a conscious experience *of the* action tendency, and the second is that the EF *is the* action tendency itself (c.f. Scarantino, 2017). According to the first view, i.e., EFs are conscious experiences *of the* action tendency (e.g., Deonna & Teroni, 2017; Moors, 2017), EF and action tendency are separate states. For example, in anger, there is the readiness to attack the offender (the action tendency), and there is the feeling of this readiness (the EF). This view had led some to a radical conclusion that EF has no or only a minimal contribution to one's readiness to act and hence also to the action itself—i.e., EF seems epiphenomenal (Moors, 2017).

According to the second view, i.e., that EFs *are* action tendencies, EFs *per se* are directed at goals (see Frijda, 2005; Mitchel, 2020); or, as we will put this henceforth, EFs are a special type of mental representation of goals and involve the representation of an end state and the motivation to pursue it. In this alternative picture, feelings might play an essential role in bringing about action.

The current paper aims to develop this second view into a detailed hypothesis we call the "feelings of goals hypothesis"

Corresponding author: Assaf Kron, University of Haifa, aba Hushi, Haifa 31905, United States.
Email: akron@psy.haifa.ac.il

(FGH). The primary commitment of the FGH is that EFs are representations of goals. This paper will focus on developing this basic insight by addressing two questions: first, what is the evolutionary function of EFs, given that they are representations of goals? Second, what are the characteristics of this special type of mental representation? As a potential answer to the first question, FGH suggests that EFs enable motoric flexibility. Specifically, the proposal is that the evolutionary advantage of EFs is that they constitute a central part of a psychological mechanism that allows differential motoric reactions to the same stimulus. We then use this conclusion to address the second question focusing on the content and the format of EFs.

The structure of the paper is as follows. We begin with working definitions of emotions and EFs, emphasizing that emotions involve flexible behavior. Next, we analyze what sort of representation a flexible movement requires. We claim that:

(a) Flexible movement requires a representation of a goal.
(b) This representation must be non-motoric.
(c) In some non-human animals, this representation must be non-conceptual.

Thus, in emotional contexts, there is a mental state with the following "job description": it is a representation of a goal in non-motoric and non-conceptual format, and it enables flexible movement. We next argue that, in light of the basic insight that EFs are representations of goals, it is plausible that EFs fulfill the job description in question. In other words, the function of EFs is to enable flexible movement in emotional contexts, and to do so, EFs need to be non-motoric and non-conceptual representations of goals. This provides an answer to both of the central questions of the paper.

Finally, we discuss the theoretical implications and empirical predictions of FGH. In a narrow version of FGH—our main commitment—EFs have the function of enabling flexible behavior (in animals that lack the required conceptual sophistication) *in emotional contexts*. This leaves open the possibility that in other, non-emotional contexts, something else—a "cold" mental state—has the same function. But later on, we also consider a broader version of FGH, according to which EFs have this function across all contexts. In other words, in this "broad FGH", EFs exist wherever flexible action exists in non-human animals that lack the required conceptual sophistication. This result has consequences regarding the type of animals that can experience EFs. Moreover, this result has implications regarding the type of actions accompanied by EFs. Specifically, if broad FGH is true, certain kinds of flexible behavior in animals that we do not usually associate with emotions, do nonetheless involve EFs.

Working Definitions

Emotions

There is little agreement about how to classify and how to define emotions (Adolphs et al., 2019; Barrett, 2006a, 2006b; Kron et al., 2013; Yik et al., 1999). Emotions are sometimes described in dimensional terms, e.g., valence (pleasant to unpleasant) and arousal (low to high arousal) (e.g., Russell, 1980, 2003; Russell & Barrett, 1999). In other cases, emotions are described in discrete terms, such as fear, happiness, disgust, anger, sadness, and surprise (Ekman, 1992; Tomkins, 1962), or play, panic, fear, rage, seeking, lust, and care (Panksepp, 2004; see also Cowen & Keltner, 2020; Nummenmaa et al., 2014 for examples of other classification systems). Usually, the object of the dimensional classification is called "affect" or "core affect", while the object of the discrete classification is called "emotion" or "emotion episode" (e.g., Russell, 2003). We will retain this distinction here and therefore use the term *affect* to refer to continuous dimensions (e.g., valence arousal) and the term *emotion* to refer to discrete emotions only (e.g., fear, disgust). However, we assume a nonspecific type of discrete classification system, and we are neutral regarding the number of emotion categories and their labels (see Tracy & Randles, 2011, for discussion).

In developing FGH, we further assume that emotion has several different components. An emotion is a profile of changes (e.g., Barrett, 2006b; Moors & Scherer, 2013; Russell, 2003; Scherer, 2003, 2009) traditionally thought to involve expression (e.g., facial, vocal), attention (e.g., orienting, vigilance), cognition (e.g., appraisal, attribution), action tendency (e.g., freezing, approaching), autonomic changes (e.g., electrodermal, heart rate), and feelings (e.g., the experience associated with fear or anger), which are the focus of FGH. FGH targets EFs specifically, rather than other components of emotions that are distinct from feelings. Hence, we ask: What problems have EFs evolved to solve? Accordingly, the answer that FGH provides for this question concerns EFs only and no other component of emotion; in other words, FGH is neutral with respect to those other components.

Emotional Feelings (EFs)

FGH can be thought of as providing a functional definition of EFs. However, since "EFs" might mean different things to different people, we first provide a minimal definition of EFs that has two components: (a) EFs, as explained above, are one component of emotion amongst others, and (b) EFs are a type of subjective (conscious) experience. For example, the specific subjective experience involved in fear, and in no other emotion, is an EF. We will thoroughly discuss the status of EFs and FGH compared to other theories; however, at this starting point, we emphasize that we do *not* assume that EFs are evaluations, perceptions (e.g., Tappolet, 2012), predictions (e.g., Barrett, 2017), a combination of arousal and cognition (e.g., Schachter & Singer, 1962), awareness to bodily changes (e.g., James, 1890), or anything else other than EFs being a component of emotion and type of subjective experience.

What is Required for Flexible Movement? A Functional Analysis

FGH states that EFs are a solution to a specific problem, i.e., it is a crucial component of a psychological mechanism that enables flexible motoric behavior. To explain the problem and why EFs are the solution, we need to defend three claims (all of which are part of FGH, as explained in the introduction). We first make the case that flexible behavior requires a representation of a goal (Claim 1). We next explain that to permit flexible response, said representation of a goal needs to be non-motoric (Claim 2). Then we argue that, for some animals, said non-motoric representation of a goal (whose function is to enable flexible movement) needs to be non-conceptual (Claim 3).

Claim 1: Flexible Movement Requires a Representation of a Goal

FGH relies on theories of emotions that link them to flexible/stimulus-decoupled behavior rather than reflexive/stimulus-coupled behavior (see below for definitions of these terms). The idea that emotional response results in reflexive or stimulus-coupled behavior can be found in the early Pavlovian conditioning literature (e.g., Rescorla, 1988), the studies of affective modulations of reflexes (e.g., Benning et al., 2004; Lang et al., 1990), and in theories that view emotion as a program that elicits pre-set behavioral patterns (e.g., Ekman, 1992). In contrast to the reflexive, stimulus-coupled behavior account, a second approach — on which we rely — holds that emotions guide flexible actions (e.g., Adolphs & Andler, 2018; Blakemore & Vuilleumier, 2017; Buck, 1985; Eder & Hommel, 2013; Frijda, 2004; Gonzaga et al., 2006; Moors et al., 2017; Panksepp, 2004; Ridderinkhof, 2017; Roseman, 2001, 2011; Smith & Ellsworth, 1985; Smith & Lazarus, 1990).

Flexibility. Movement is defined as a distinct temporal pattern of muscle contractions. The potential relationships between stimulus and movement can be thought of as a continuum between two poles: at the one pole, a specific stimulus and movement pair is completely coupled – that is, the probability of a specific movement given a specific stimulus (or stimuli) is approaching one. At the second pole, the stimulus and movement are completely decoupled – that is, the probability of specific movement given a stimulus (or stimuli) is approaching zero. A coupled stimulus-movements relationship might reflect one of two patterns of associations: one-to-one associations and many-to-one associations. In one-to-one associations, a specific stimulus results in one specific movement or a specific sequence of movements. The withdrawal reflex is a prototypical example of a one-to-one association. In the withdrawal reflex, a potentially harmful stimulus causes the limb to withdraw (Pearson & Gordon, 2013). For instance, in a dog's leg withdrawal reflex, stimulation of the area between the toes of the dog's rear left leg will cause this leg (and no other legs) to pull upward and forward. The cornea reflex is a prototypical example of a many-to-one relationship. In the cornea reflex, stimulation of the left cornea or stimulation of the right cornea will both result in the blinking of both eyelids. One-to-one and many-to-one associations are examples of coupled relationships since the probability of a specific movement given a specific stimulus (or stimuli) is approaching one. Decoupled relationships reflect a one-to-many association in which a stimulus can result in many different movements or sequences of movements. An example of a one-to-many association between stimuli and movement is the behavior of a lioness attacking an oryx. Although the lioness aims to decrease the distance to the oryx (to catch it), the actual movements carried out to meet this goal are varied (Stander, 1992). To clarify, the lioness' behavior involves different patterns of muscle contractions, hence different movements. Similarly, the oryx tries to increase the distance from the attacking lioness, and the oryx's movements vary from one attack to the next[1]. We henceforth define flexible movement in terms of a decoupled relationship between stimulus and motor response.

Flexibility Requires a Representation of a Goal. As clarified above, critical to FGH is the assumption that flexible motoric response requires a representation of a goal or goals. A representation of a goal, in our understanding, is a representation of an end state that motivates the agent to reach it (c.f. Carver & Scheier, 1981; Fishbach & Ferguson, 2007; Gollwitzer & Moskowitz, 1996; Locke & Latham, 1990). The assumption that flexible motor response requires a representation of a goal can be justified by considering whether it is possible to decouple stimulus and response without representing a goal. No represented goal means no common end state to the differential motoric responses. Without a common end state, the motoric reactions can be thought of as random. A random movement in response to stimuli makes no adaptational sense; imagine the lioness that instead of attacking an oryx initiates random movements.

The link between motor flexibility and representation of a goal is highly accepted and frequently assumed in the psychological literature. For example, the distinction between coupled and decoupled relationships maps onto the traditional distinction between stimulus-driven versus goal-directed behavior (e.g., Dickinson & Balleine, 1994; Moors, 2017; Moors et al., 2017; Wood & Neal, 2007).

Stimulus-driven movements are initiated by stimulation of a specific receptor (usually called reflexes) or characterized by a strong link between stimulus and one specific motor plan. Goal-directed movements are thought to strive toward an end state via different motor plans. In the psychology of behavior, the phrases *stimulus-driven* and *goal-directed* come with an array of assumptions supposing the first is automatic and the second controlled (for discussions, see Keren & Schul, 2009; Moors, 2014). We do not hold these assumptions here (see Moors et al., 2017). We also do not assume that goal-directed movements are "deliberate" or "voluntary". To minimize our assumptions, we emphasize only that stimulus-driven movements are characterized by a coupled relationship between stimulus and movement (or motor plan) whereas goal-directed movements require decoupling the two.

Claim 2: The Representation of a Goal (from Claim 1) Must have a non-Motoric Format

The question "how is a goal represented?" can be tackled by distinguishing between the format and content of mental representations. The content of a mental representation is *what* it represents. The format of a mental representation is the *way* it represents its content (Quilty-Dunn, 2016). For example, an *apple* content can be represented in different formats: as a mental image of an apple (i.e., with iconic format) or as a proposition (i.e., with conceptual format). Described in terms of content and format, Claim 1 is about the content of representation: flexible movement requires a representation of an action goal; the action goal is its content. Claim 2 is about the format of this representation; the claim is that the action goal should be represented in a non-motoric format, where the motoric format is a representation via motor plans or muscle contractions (Butterfill & Sinigaglia, 2014). Why accept the second claim? To decouple stimulus from movement, an animal must not represent an end state in terms of the movements themselves. That is, the goal must not be represented in terms of all the precise muscle contractions or a motor plan that leads to the end state or to the exact route to the end state – otherwise, the ensuing movement, by definition, would be reflexive or stimulus-driven and no longer be decoupled (i.e., in the case of reflexes, the end state is dictated by a specific sequence of muscle contractions; in the case of stimulus-driven movement, the end state is dictated by a particular plan of motor). Hence, the decoupling of stimulus and movement requires a representation of an action goal, which has a *non-motoric* format (a non-motoric representation of an action goal, in short).

How could a goal be represented given the constraint of non-motricity? Next, we consider the case of a conceptual representation of a goal as an alternative to a motoric representation. We briefly explain what conceptual representations are and agree with psychological literature that humans have the capacity of a conceptual representation of goals. However, we then move to defend Claim 3, according to which some non-human animals that demonstrate flexible movement do not possess conceptual representation of goals. This sets the stage for the solution of FGH to the question of how a goal can be represented non-motorically.

Conceptual versus non-Conceptual Representations. The formats of mental representations can be divided into conceptual and non-conceptual (Pitt, 2020). Perhaps the most common type of conceptual format is a discursive format that carries information in a way that is analogous to a sentence in natural language and is composed of "words" (symbols) that express *concepts* (as in the influential "language of thought" hypothesis of Fodor, 1975). Discursive format, therefore, implies concepts, however, the converse may not hold – some argue that concepts might be realizable in a non-discursive, yet compositional format (Young, 2020). Certain formats are thought to be non-conceptual. One example is the iconic (picture-like) format that is sometimes thought to underlie the phenomenology of visual experience (Balog, 2009; Block, forthcoming; Fodor, 2008). A second example of a non-conceptual format is analog magnitude representations (Carey, 2009), which represent magnitudes, such as the number of objects, duration, and distance. In this format, degrees of change in a vehicle correspond to degrees of change in the magnitude represented by this vehicle (see Beck, 2019). A third example of a non-conceptual format is a motoric format (Butterfill & Sinigaglia, 2014), namely a representation via motor plans or muscle contractions (as in the motoric representations of end states discussed in the previous section).

Psychologists have generally discussed goals in terms of discursive, conceptual formats (e.g., Abelson, 1981; Galambos et al., 1986; Gioia & Poole, 1984; Foss & Bower, 1986; Kruglanski et al., 2002; Lord & Kernan, 1987; Ortony et al., 1988; Schank & Abelson, 1977). While there is no doubt that humans can use conceptual representations of goals (Kruglanski et al., 2002), a question arises regarding how the oryx, which shows decoupling behavior, represents the goal of keeping a safe distance from a lioness, given that the representational format is non-motoric. A conceptual representation of such a goal should involve a conative[2] representation of the end state that might include concepts such as KEEP, DISTANCE, and SAFE. Such a representation requires the support of a developed meaning system of concepts. Is it plausible that the oryx possesses such a system? We address this issue in the next section.

Claim 3: For Some Non-Human Animals, non-Motoric Representations of Goals (from Claim 2) are non-Conceptual

Conceptual formats could be used as an alternative to the motoric format of representations of action goals in humans.

Can this solution explain flexible motoric behavior in *all* animals that show decoupling of stimulus and movement?

To clarify, the motivation to ask this question comes from the combination of Claims 1 and 2. Claim 1 is that flexible movement requires the representation of a goal. Claim 2 is that the format of said representation must not be motoric. The conceptual format is a potential alternative to the motoric format. If the answer to the question from the preceding paragraph is "yes" and all animals that show decoupling are also capable of conceptual representation, then the conceptual format is a possible solution to the problem of flexible behavior in non-human animals. Otherwise, another solution is needed. We next explain why we think conceptual representation cannot be a plausible solution for all animals that show flexible movement.

Animals' conceptual representation. A thorough discussion of the conceptual system in animals with a full review of empirical data and theoretical and philosophical positions is beyond the scope of this paper (e.g., Lurz, 2009; Zentall et al., 2008). Here, we present the topic from a bird's-eye view that will enable us to map it out, making it possible to ask whether there are animals that show decoupling of stimulus and movement and yet cannot represent goals conceptually.

Psychologists generally emphasize the categorical hierarchical structure of the conceptual system (Markman, 2013). Therefore, it is widely assumed that if animals show an ability to perform complex discrimination and classification tasks, the latter attests to underlying categorical or conceptual hierarchical structures (Zentall et al., 2008 but see Vonk & MacDonald, 2002). Accordingly, the first type of evidence for a conceptual representation in animals involves demonstrating the ability to perform complex discrimination and classification tasks. Examples of such evidence include the ability of pigeons to respond to the presence (vs. absence) of humans in photographs and to generalize it to novel stimuli (Aust & Huber, 2002; Herrnstein & Loveland, 1964), or the ability of Rhesus monkeys to learn to respond to an image of a tree versus non-tree and generalize the response to unseen images (Vogels, 1999). The second type of evidence for conceptual structure in animals comes from the ability of animals to discriminate between and classify stimuli based on their history of overlapping (many-to-one) associations with other common stimuli (sometimes referred to as "associative class"). Demonstrating classification based on previous associations is usually interpreted as the formation of a common representation. Such an ability, to produce a common representation that is based not on the common perceptual feature but rather on a history of overlapping associations is assumed necessary for higher-order categorization and arbitrary symbolic representation (e.g., Urcuioli et al., 1989).

The third type of evidence for conceptual representation in animals comes from referential signaling. Some animals demonstrate signals (usually vocalization) that appear to refer to a specific class of objects or events. For example, Vervet monkeys have distinct calls that signal different types of predators: snake, leopard, and eagle (Seyfarth et al., 1980; Struhsaker, 1967). Rhesus macaques use different types of alarm calls that code the social rank of the opponent and the intensity of its aggression (Gouzoules et al., 1984; Gouzoules & Gouzoules, 1989: for other examples of lemurs and domestic chickens see Macedonia, 1990; Gyger et al., 1987). Such an ability of referential signaling is frequently interpreted as evidence for the existence of conceptual representation (Gil-da-Costa et al., 2004; Stephan, 1999).

The fourth type of evidence for conceptual representation in animals comes from the ability to perform same/different abstract concept learning. Same/different learning relies solely on the relationship between stimuli and not on the physical features of the stimuli. For example, an ability to behave according to whether two stimuli are the same or different was demonstrated in capuchins, baboons, and rhesus monkeys (Bhatt & Wright, 1992; Bovet & Vauclair, 2001; Katz et al., 2002; Wright et al., 2003), pigeons (Katz & Wright, 2006), parrots (Pepperberg, 1987), and Clark's nutcrackers (Magnotti et al., 2015).

The degree to which the above empirical findings are evidence for conceptual representation is a matter of debate and depends on the definition of conceptual representation and, critically, on whether one accepts the possibility of concepts without natural language (for linguistic approaches see Bermúdez, 2003; Chater & Heyes, 1994; Davidson, 1985; Searle, 1994; for non-linguistic approaches see Allen, 1999; Allen & Hauser, 1991; Beck, 2018; Carruthers, 2004; Evans, 1982; Stich, 1979). The position we present here is that even if one assumes that non-linguistic conceptual representations exist, and even if one permits a liberal interpretation of the evidence regarding conceptual representation in animals, still, the empirical evidence suggests a conceptual system that does not reach a minimum limit to support a conceptual representation of certain goals, for certain animals. Consider again the potential conceptual representation of the oryx's goal when running away from the lioness. To form this potential conceptual representation of a goal, the oryx must possess concepts, such as KEEP, SAFE, DISTANCE, FROM and be able to grasp the complex relationship between them. We think that, given the evidence regarding mental representations in non-linguistic animals, and given the accounts of non-linguistic conceptuality we have surveyed, it is plausible that the oryx's representation of its goal is non-conceptual. Hence, to explain flexible movement in such animals, we must appeal to non-conceptual (and non-motoric) representations of goals. This is where, according to FGH, emotional feelings come into play, as we explain in the next section.

The Feelings-of-Goals Hypothesis (FGH): Emotional Feelings (EFs) are a non-Motoric, non-Conceptual Representation of Goals

The discussion up to this point formulates necessary psychological conditions for non-arbitrary flexible movement during emotion response; it first assumes that emotion involves flexible movement. Second, it shows that (non-arbitrary) flexible movement requires the representation of goals. Next, it sets two constraints on the representations of goals in organisms that show decoupling of stimulus and movement and that have a limited conceptual system: representations of goals should be non-motoric and non-conceptual (Claims 2 and 3 above).

The FGH suggests that EFs are such non-motoric, non-conceptual representations of goals. The rationale is this: given that emotions involve flexible behavior and that flexible behavior (in certain animals) requires non-motoric, non-conceptual representations of goals, and given the basic insight (coming from the "felt action tendencies" tradition) that EFs represent goals, FGH proposes that EFs are nature's trick to solve the problem of flexible behavior, at least in emotional contexts, and consequently EFs' format is non-conceptual and non-motoric.

From a broader theoretical perspective, FGH can be thought of as a potential answer to the theoretical question, "what is the content of emotional feelings?" (e.g., Lambie & Marcel, 2002) and specifically as a development of the felt-action-tendency tradition, which claims that the content of EFs is an action goal (e.g., Frijda, 2004). We next discuss the content and the format of EFs according to FGH and how it relates to the previous alternative approaches.

The Content of EF

FGH suggests that the content of EF is an action goal; an end state and the motivation to reach it. In other words, organisms that demonstrate flexible responses, feel action goals. For example, according to FGH, the feeling of fear might be a non-conceptual non-motoric conative representation of something like the end state "avoid X" or "keep a safe distance from X"[3]. The feeling of shame, in the same way, could be a conative mental representation that has a non-conceptual and non-motoric format whose content is the end state "conceal yourself, cover-up", and the feeling of anger might be a similar kind of mental representation but with the content "attack X".

We next briefly describe extant theories of the content of EFs (see also Lambie & Marcel, 2002 for a review), or in other words, theories of what EFs represent, and compare FGH to them. We focus on four types of views: EFs as interoceptions of bodily changes, EFs as representations of values, EFs as a mixture of experienced arousal and cognitive evaluations, and EFs as felt action tendencies.

EF as interoceptions of bodily changes. According to Jamesian or neo-Jamesian traditions, EFs are inner perceptions (interoceptions) of peripheral bodily changes (e. g., James, 1890; Prinz, 2005; Tomkins, 1962). Perceiving stimuli causes bodily changes including autonomic and skeletal responses. Some of these changes can be sensed by mechanisms of inner perception (e.g., sensing the heart rate, face temperature, or motoric changes – for related empirical work see also Nummenmaa et al., 2014). The peripheral bodily changes are, according to Jamesian traditions, the content of EF.

The Jamesian claim that the EFs are interoceptions of peripheral bodily changes entails that different patterns of peripheral activations could be potential markers for different types of EF. This prediction of the Jamesian claim has limited empirical support; peripheral measures consistently correlate with valence and arousal but less consistently with EF of discrete emotions (see e.g., Barrett, 2006a, 2006b, for a review but see also e.g., Kragel & LaBar, 2013). FGH does not ignore the existence of interoceptions of peripheral bodily changes, and it can even accept that during experiencing EFs such feelings occur. However, according to FGH, EFs and interoceptions of peripheral bodily changes are different types of feelings.

EF as representations of values. A second group of theories holds that the content of EF is an object's value (e.g., Barrett, 2006a, 2006b; Brown, 1990; Dolan, 2002; Döring, 2007; Goldie, 2000; Pugh, 1977; Russell, 2003; Tappolet, 2000). Value, according to these views, is not only represented by cognitive judgments but also by EFs. Examples include: theories of core affect, which state that the experience of valence (pleasure and displeasure) represent the object as being positive/negative, good/bad (e.g., Barrett, 2006a, 2006b; Russell, 2003 and see also Dolan, 2002); theories that posit non-cognitive value systems that enable learning and action selection (e.g., Brown, 1990; Pugh, 1977) and perceptual theories in which EFs are (conscious) perceptual representation of values of an object – for example, fear is the (conscious) perceptual representation of an object as being dangerous, sadness is the (conscious) perceptual representation of losing something important (Döring, 2007; Goldie, 2000; Tappolet, 2000). Let us consider each view in turn.

Valence is a simple bipolar positive-negative representation of a value and as such it cannot capture the difference between discrete emotions (e.g., fear, disgust, shame), which is what EFs do, according to FGH. The potential relationship between core affect and EF is part of a long-lasting debate in affective science (Barrett, 2017; Yik et al., 1999). Here we address only one aspect that is relevant to the content of EF. There is a traditional view in which different discrete emotions can be mapped onto dimensions of core affect (degree of valence and arousal – e.g., Russell, 2003). If indeed all EFs can be conceived in terms of valence and arousal, it means that either a) core affect, valence in particular, is a common qualitative ingredient that can be found in all EFs. Specifically, the motivation to reach an end state (the conative component of the feelings of goals) might contain valence as one of its ingredients; or, b) core affect, valence in particular, is not a feeling per se but rather a superordinate semantic category that can be used to classify different EFs in terms of being positive and negative. That is, valence is not a dimension of subjective experience but rather a sematic label. FGH is indifferent to whether valence is an ingredient of EF or is a semantic label, or both, since FGH focuses on the non-motoric, non-conceptual nature of EF.

Now consider perceptual theories, according to which the content of EF is perceived as the valuation of an object. Perceptual theories hold that the content of EF is the meaning of the object to the perceiver (perceived valuations). In contrast, FGH utilizes a more primitive type of representation, namely a representation of action goals. Consider, for example, the case of an EF of fear: whereas perceptual theories hold that the content of the EF is (roughly) "this object is dangerous", FGH holds that the content of the EF is (roughly) "keep a safe distance from this object". An oryx need not represent the lioness as being dangerous but instead, simply run away in a flexible manner. This is compatible with holding that, with humans, fear involves a conceptual representation of valuation, such as dangerousness. Remember that fear, like all emotions, is a cluster of components, only one of which is EF. Therefore, a conceptual representation of dangerousness could be a component of fear in humans, alongside EF.

EF as experienced affect and cognitive evaluation. Several theories (e.g., Barrett, 2017; Lazarus et al., 1980; Mandler, 1990; Schachter & Singer, 1962) hold that EF is a mixture of affect and cognition. For example, Schachter and Singer (1962) suggest that EFs are composed of both perceived arousal and a cognitive label that reflects attribution or interpretation of the perceived arousal (see also Zillmann et al., 1972). Mandler (1990) suggests that EF is a holistic unitary experience composed of perceived visceral arousal and a cognitive evaluative schema. A modern, sophisticated version of this approach is the theory of constructed emotions (Barrett, 2017), which states that in order to experience emotion, core affect needs to be categorized via an emotion concept. FGH is fundamentally different from the theory of constructed emotions, since according to the latter, a conceptual component distinguishes between different types of EF. FGH, contrarily, assumes no conceptual component in EFs. What differentiates EFs is the type of action goal they represent.

EF as felt action tendencies. A fourth group of theories holds that EFs are felt (or conscious) action tendencies, a view that originated in Arnold's (1960) work. Action tendencies are frequently thought to be a prominent component of the emotional response (e.g., Arnold, 1960; Blakemore & Vuilleumier, 2017; Carver et al., 2000; Ekman, 1992; Frijda, 2004; Gray, 2008; Hillman, 1960; Hommel et al., 2017; LeDoux, 1996; Ridderinkhof, 2017; Sander, 2013; Scarantino, 2014; Scherer, 2009; Smith & Lazarus, 1990). The term "action tendency" has various meanings in emotion literature. It is sometimes used to refer to overt action execution, namely activation of an affective program resulting in a specific behavior, such as the production of facial expressions (Ekman, 1992); to affective modulation of reflexes (Benning et al., 2004; Lang et al., 1990); to physiological changes, such as autonomic responses or skeletomotor changes that are assumed to prepare the body to act (e.g., Lang et al., 1993); or to the representations of an action or an action plan (Moors et al., 2017). The "felt action tendency account" holds EFs to be conscious action tendencies (Arnold, 1960; Deonna & Teroni, 2012; Frijda, 2004; McDougall, 1928; Moors et al., 2017). For example, Frijda (e.g., 2004) suggests that an EF is, to a large extent, an experienced action tendency or an experienced state of action readiness. In a more recent version of his idea, Frijda (2005) develops the notion of felt action tendency and suggests that "[a]ction readiness is reflected in the objects and places demand characters of 'to be removed', 'to be distanced from', or 'to be united with'" (see also Mitchel, 2020). Deonna and Teroni (2012) propose that EFs are feelings of the body (i.e., heart rate, etc.) as ready to act in a certain way (for an interesting variant of this approach, see Shargel & Prinz, 2018). Moors et al. (2017) suggests that EFs are aspects of action tendencies that seep into consciousness.

As explained in the introduction, within the "felt action tendencies" tradition, there are two potential ways to understand the relationship between the action tendency and the EFs: the first is that EFs and action tendencies are separate states, where one (EFs) is the conscious experiences of the other (action tendencies) (e.g., Deonna & Teroni, 2017; Moors, 2017). In the second, EFs and action tendencies are the same state-- EFs are the action tendencies themselves (see Frijda, 2005; Mitchel, 2020).

FGH is a development of the "felt action tendency" tradition and specifically of its second version. With that tradition, FGH links EFs and action tendencies by suggesting that the content of feelings is an action goal. In support of its second version, on which EFs are action tendencies, FGH claims that it is not that EFs are simply the seeping of action tendencies into consciousness (i.e., EFs are epiphenomenal) but rather that EFs are a special way (non-motoric, non-conceptual) of representing a goal. Critically, EFs have an evolutionary function and a role in allowing flexible movement.

The format of Ef. As we have seen, FGH involves two constraints regarding the format of the representation of an action goal (if it is to qualify as an EF): an action goal must be represented in a non-motoric *and* non-conceptual format. EF is a feeling of an action goal, in virtue of representing it in a non-motoric and non-conceptual way.

The claim regarding the non-conceptual format of EF is not as radical as, perhaps, the claim that an action goal is the content of EF. Frequently, when both laypeople and scientists use the term *feelings*, they mean "a non-conceptual mental state". Similarly, although most of the theories of EF do not explicitly specify its format, it is quite clear that many of them, when referring to feelings, assume some sort of "non-cognitive" or "non-conceptual" format. The first example comes from the Jamesian traditions (e.g., Deonna & Teroni, 2012; James, 1890; Prinz, 2005; Tomkins, 1962) in which EFs are *sensations* of bodily (peripheral) changes. James contrasts feelings with cognitive judgment: "Without the bodily states following on the perception, the latter would be purely cognitive" (1890, p. 449). A second example comes from theories in which the content of EF is a value: Brown writes: "…values drive the human system, and those values relate to feelings, not to reason…" (1990, p. 409). A third example comes from theories in which EFs have evolved evolutionarily before language and concepts. A prominent representative of such a view is Panksepp (e.g., 2004) who assumed that all mammals have the capacity to experience EFs. A fourth example comes from the appraisal tradition. True, appraisal theories usually hold that some cognitive, perhaps conceptual processes, are involved in the decision whether to elicit an emotional response or not (Moors et al., 2013). Yet a theory that holds that a cognitive appraisal is part of the emotion elicitation process need not conclude that the representational format of EF is (even partly) *per se* conceptual. An example of an appraisal theory that permits a non-conceptual representational format is the Computational Belief-Desire Theory of Emotion (Reisenzein, 2009), according to which EFs are non-propositional signals that are the immediate output of conceptual appraisal processes.

Some accounts do not agree with FGH regarding the non-conceptual representational format of EF. One example is the appraisal theory of Smith and Ellsworth (1985), that, in our interpretation (see also Lambie & Marcel, 2002 for a similar view of Smith & Ellsworth), implicitly sees cognitive appraisal not only as a decision algorithm taking place before emotion elicitation but perhaps as part of the EF itself and as such might imply that EFs have a conceptual format. Another well-known example is the theory of constructed emotions (Barrett, 2017), according to which basic emotions are the result of a "conceptual act" in which the experienced core affect (i.e., feelings of pleasant-unpleasant and calm-aroused) is categorized into discrete emotions (e.g., fear, disgust). This categorization is an EF that involves both conceptual and non-conceptual elements. Consequently, contrary to theories that assume that animals have the capacity for emotional experience (e.g., Panksepp, 2004), the theory of constructed emotions holds that without the support of a conceptual system (as in the cases of babies and animals) one experiences only core affect (pleasure and displeasure) and not discrete emotion episodes, such as happiness, anger, fear, and disgust (Barrett, 2006a, 2017).

Theoretical Implications of FGH

In the preceding section, we have surveyed the direct potential contributions of FGH: the characterization of EFs as mental representations -- a theoretical tool that allows thinking about the content and format of EFs; the relevance of FGH to the theoretical discussion about the content of EFs; the theoretical development of the relationship between action tendency and EFs within the felt-action-tendency tradition; and the proposal that EFs have an evolutionary function, namely that they are a crucial component of a psychological mechanism that enables flexible motoric reactions. Aside from these contributions, FGH has broader theoretical implications, some of which were mentioned above in passing. Next, we briefly put on the table, for the aim of future discussion, what we believe to be three of the most interesting possible offshoots of FGH.

Our basic commitment is to the claim that EFs enable flexible behavior in clear cases of emotions (such as fear in the case of the oryx). Yet, it might be possible to try to extend this approach more broadly and argue that EFs are involved in all cases of flexible behavior, at least for some subclasses of animals -- call this "broad FGH". While we are not going to argue for it, broad FGH looks prima facie plausible because non-emotive cognition, or "cold cognition," does not seem to involve non-conceptual, non-motoric representations of goals, as far as we are aware. Two out of the three theoretical implications we consider next concern such a "broad" version of FGH.

Which non-Human Animals Experience EFs?

Theorists of emotions debate about the phylogenetic stage in which animals begin experiencing EFs (for reviews see Edelman & Seth, 2009; Morin, 2012). EFs are a special case of conscious experience, hence the question of whether animals experience EFs relates to the question of whether animals have conscious experiences. Two positions that could be presented as antithetical are those of LeDoux and Brown (2017) and Panksepp (2004). LeDoux and Brown (2017) claim that human EFs, like any other types of conscious experiences, depend on higher cortical structures unique to humans and high primates and arise as exaptations in early humans (LeDoux, 2019). According to LeDoux, whether non-human primates and other animals have consciousness is difficult to determine for methodological reasons (see also Macphail, 1998; Rolls, 1999). Panksepp posits a hierarchy of levels of conscious experiences. The most primitive form of consciousness is EF ("affective awareness" in his terms), which springs from subcortical areas and is shared by all mammals. Next in line is the cognitive awareness of primates, after that comes the self-awareness of great apes, and finally the awareness of awareness, which only humans possess. On the continuum between Ledoux and Panksepp, FGH is closer to Panksepp and perhaps more radical. So far, when claiming that EFs enable flexible behavior in animals with a limited conceptual system, we did not explicitly distinguish between mammals and other groups. In light of Panksepp's emphasis on mammals, it is possible to describe a moderate and an extreme version of broad FGH. In a moderate version of broad FGH, all flexible behavior in *mammals* with a limited conceptual system implies EF. This version agrees with Panksepp that all mammals experience EFs, and it leaves open the possibility that a different kind of mental state (not an EF) enables flexible behavior in birds and reptiles, for example. In an extreme version of broad FGH, flexible behavior in *all* animals (not only mammals) with a limited conceptual system implies EF. Consequently, an extreme version of broad FGH would claim that *every* animal that demonstrates flexible behavior (decoupling of stimulus from movement) and has a limited conceptual system, experiences EF.

Does Building a Nest Require an Emotional Feeling?

Broad FGH has implications not only concerning the species of animals that experience EFs (i.e., those who show decoupling and have a limited conceptual system) but also concerning the type of emotions animals experience. Broad FGH opens the door for new types of emotional experiences. For example, consider a bird that is building a nest. If this behavior is flexible in the sense we have defined above, and if it is likely that the bird lacks *concepts* such as NEST and BUILDING, then broad FGH (in its extreme form outlined above) predicts that the bird has an EF – it feels the goal of nest building. This result can be interpreted in two ways. According to the first, the bird not only has an EF (a feeling of the goal of nest building), but this EF is accompanied by all the other components in the cluster we call "emotion". Consequently, there is an emotion type that is associated with nest building, for which we lack a name. In this interpretation, accurate taxonomy of emotions should be relying on types of action goals that enable flexible movements. According to the second interpretation, the EF the bird experiences is not accompanied by all the components required for the bird to have an emotion in the full sense of this term (for example, perhaps the EF is not activated by an appraisal). This means that there is no emotion type associated with nest building. Moreover, this means that the set of EF types is larger than the set of emotions: while all emotions involve an EF, not all EFs are a part of an emotion.

Are Reflexes and Stimulus-Driven Actions Part of the Emotional Response?

FGH claims that EFs come into play when flexible behavior is at stake. How is this reconciled with the association between EF and some reflexive and stimulus-driven behaviors? For example, the eye blink startle reflex is associated with negative feelings and is mediated by the affective context, i.e., positive context attenuates and negative context increases blink magnitude (e.g., Lang et al., 1990). To take another example, some facial expressions are thought to be stimulus driven and reflexive, such as the activation of the levator labii during disgust, which is also correlated with self-reports of feelings (Chapman et al., 2009).

While the correlation between EFs and reflexes and stimulus-driven behaviors is not a challenge to FGH, it entails a componential structure of the emotional response. Specifically, FGH is a hypothesis about EFs which are one specific component (of the emotional response) among several others. A response to an event might begin with initiating a sequence of reflexes that provides a suboptimal solution (Bradley & Lang, 2007; Cosmides & Tooby, 2000; Plamper, 2012) and then activate an EF to guide flexible behavior (for a discussion on sequence models of reflexes in the emotional response see Bradley et al., 2001; Lang et al., 1993). From an experimental perspective, the correlation between EFs and reflexes/stimulus-driven responses can be thought of as a spurious correlation – it occurs because of a mutual context (both are part of the emotional response) and not because of a constitutive link between the two. In the next section we develop this point into one of the empirical predictions of FGH.

Empirical Predictions

As with every scientific hypothesis, FGH is expected to provide empirical predictions that will be used for support or refutation. Since FGH is a hypothesis about subjective experience, empirical investigation of it is *prima facie* challenging. While a detailed research agenda is beyond the scope of this review, below we outline two families of predictions that are derived from FGH and that with further development could be used as a basis for various research questions and empirical examinations.

Prediction No. 1: meeting a relevant action goal will cease the emotional response. FGH claims that each type of EF is a representation of a different action goal. Hence, FGH predicts that meeting this action goal will deactivate the EF in question. For example, if in fear one feels the goal of "keeping distance from X", then FGH predicts that there is an end state (e.g., being distant from X), such that when it is reached, the EF of fear will subside. If the goal of the EF of disgusts is to "prevent contagion", FGH predicts that there is an end state, such that when reached by action (e.g., rejection of rotten food or keeping distance from a dead body or from a sick person), the EF of disgust will subside. Note that FGH acknowledges that there are other ways to attenuate EFs – obviously, humans with their powerful cognitive abilities have developed sophisticated strategies for emotion regulation (e.g., reappraisal, distraction) that do not rely on motoric action. Yet, FGH predicts that given the evolutionary context in which EFs have developed, it could be attenuated by reaching an action goal.

Prediction No. 2: spurious correlation between EFs and reflexes will break down as time passed from the initial exposure to a stimulus. As was discussed above, there are various known statistical associations between EF and reflexes and stimulus-driven responses (e.g., Lang et al., 1990). FGH implies that these associations are spurious and predicts that they will break down in later stages of the emotional response. Reflexes and stimulus-driven behaviors are expected to begin with exposure to a stimulus and to cease after a specific motoric sequence is executed. In contrast, while EFs begin with exposure to a stimulus, according to FGH they will end only when the relevant end state is reached, regardless of the specific chain of movements that is executed. Consequently, FGH predicts that EFs will last longer than reflexes and stimulus-driven behavior, and thus, in later stages of the emotional response, EF will not be correlated with reflexes and stimulus-driven behavior. A supplement to prediction 2: FGH predicts an association between EFs and flexible movement. That is, during the emotional response, the intensity of EF will be associated with a higher degree of variance in movement.

Interaction Between Conceptual and non-Conceptual Representations

Humans, unlike most animals, can represent goals both in a conceptual format and, if FGH is correct, via EFs with a non-conceptual, non-motoric format. This ability of humans raises complexities that we have not addressed in this paper. Perhaps the most fascinating question in this context is whether, and how, conceptual and non-conceptual formats interface. For example, how can a *conceptual* judgment lead, in a logically suitable way, to a creation of a *non-conceptual* representation of a goal (with its non-conceptual format)? Does this require an implausible translation mechanism between the two formats? To defuse this concern, note that the issue of translation (or interface) from conceptual to non-conceptual formats is not unique to emotion and arises in other contexts as well, specifically the influence of intention, with conceptual format, on motor plans, with motoric format (Butterfill & Sinigaglia, 2014; Mylopoulos & Pacherie, 2017), and the influence of thoughts, with conceptual format, on perception, with iconic format (Brössel, 2017; Burnston, 2017).

Coda

In this paper, we have presented and developed FGH. FGH is a potential theoretical attractor for many extant views in which EF relates to flexible behavior. FGH suggests that EFs are non-motoric, non-conceptual representations of action goals: when experiencing EFs, humans and animals experience action goals. We have proposed that such representations have an evolutionary advantage: they enable flexible motoric response (one-to-many associations between stimulus and movement) in animals with a limited conceptual system.

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ORCID iD

Assaf Kron https://orcid.org/0000-0003-0127-0232

Notes

1. Note that in the literature there is another meaning for the term "coupling" that is different from ours. For example, Griffith and Scarantino (2008) would describe the oryx's behavior as *coupled* since it responds to the lioness' presence via *one* action type, namely fleeing and protecting itself. We count this behavior as *decoupled* because the oryx can choose various movements to achieve the same goal.
2. Conative representations are a family of mental representations that do not aim to represent how the world is but rather how the world should be from the agent's perspective (they have a "world to mind direction of fit", see Anscombe 1963). We use this term here to emphasize that a representation of a goal includes both a representation of the end state and a motivational component.
3. It might be misleading to say that the content of the emotional feeling is "keep a safe distance from X", since this content seems linguistic and conceptual. It is more accurate to say that the feeling has a content that *we* (adult humans) would describe as "keep a safe distance from X". Put differently, the non-conceptual content of the emotional feeling is *equivalent* to the conceptual content "keep a safe distance from X." The two contents are equivalent in that both are satisfied by the same state of affairs, namely the animal actually keeping a safe distance from X. In other words, the satisfying conditions of both contents are the same.

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